# Regional Ocean Models for the U.S Caribbean Islands and Florida Bay

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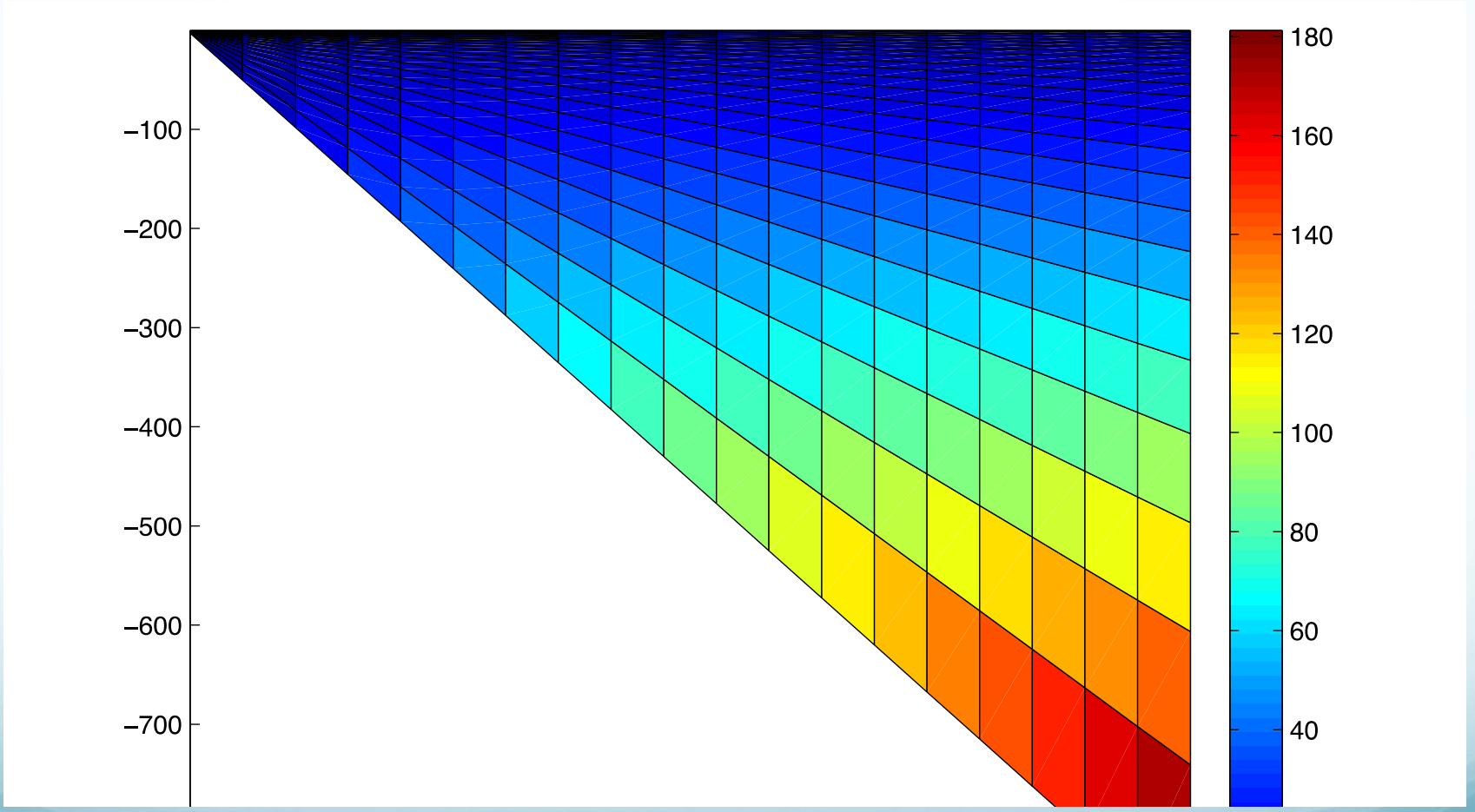
# Outline

1. The Regional Oceanic Modeling System (ROMS)
2. Northeastern Caribbean Model: US Caribbean Coral Reef Ecosystem Connectivity
3. South West Florida Shelf Model: Pink Shrimp Larval Transport
4. Conclusions

# ROMS

- Regional Oceanic Modeling System
- Momentum (Navier-Stokes) and tracer advection equation
- Forced by atmospheric fluxes (heat and water from atmospheric models) and tides (choice of tidal constituents)
- T, S ,U, V and SSH discretized on a 3-D grid
- Vertical coordinate system allows for high resolution in shallow waters (Regional)

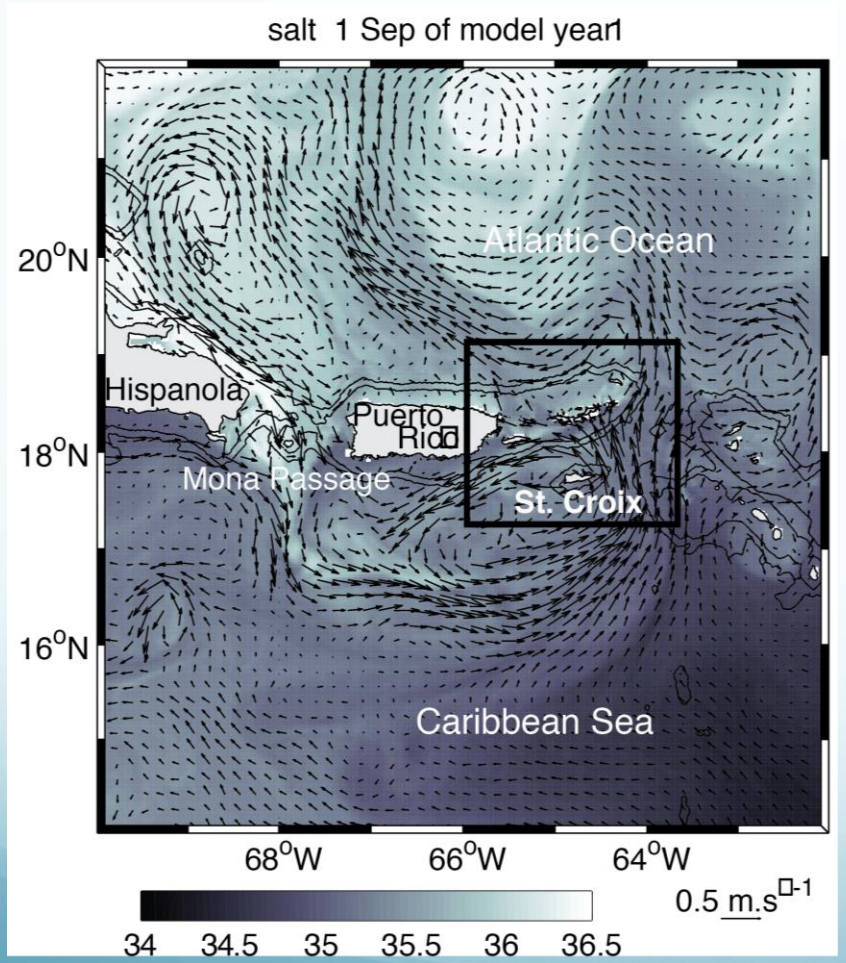
# ROMS

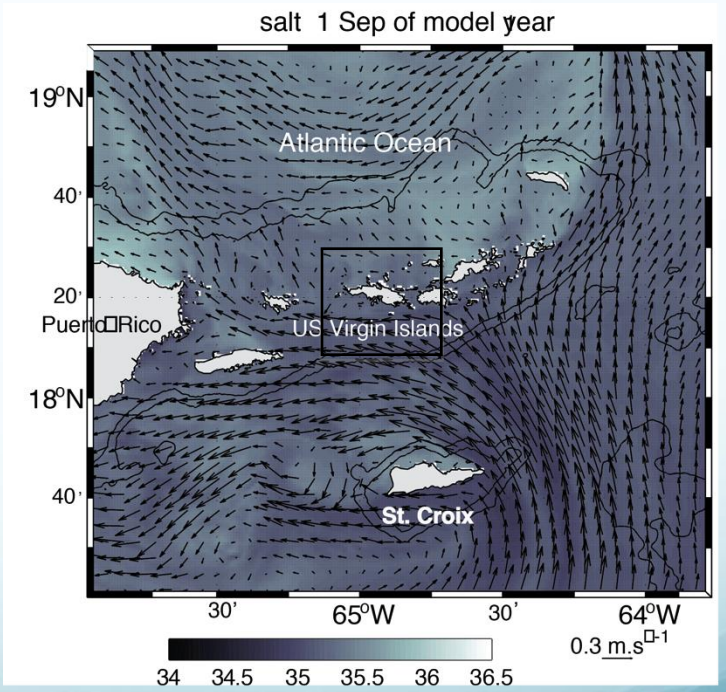


# ROMS

- Lateral forcing: relaxation to state variables from climatology or other model fields (HYCOM)
- Stability at boundaries: radiation/nudging open boundary conditions (no T or S bias)
- ROMS_AGRIF: refine the grid on areas of interest
- Two-way nesting

# Northeastern Caribbean Model



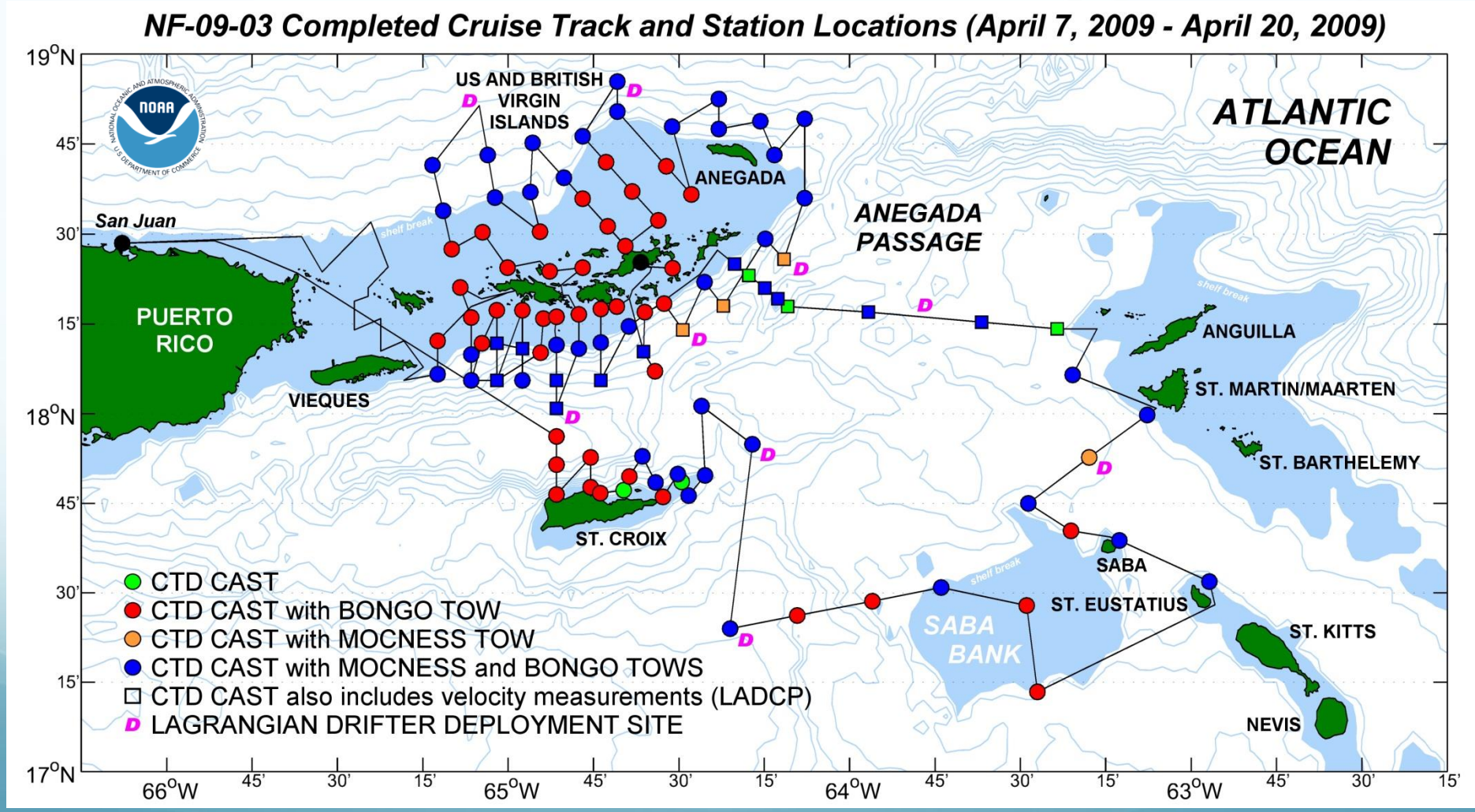
# US Caribbean Coral Reef Ecosystem Connectivity: Vieques Sound and Virgin Passage Transport Study

*US Caribbean MPA efficacy assessment requires a more comprehensive understanding of relevant larval recruitment pathways and region-wide habitat connectivity.*

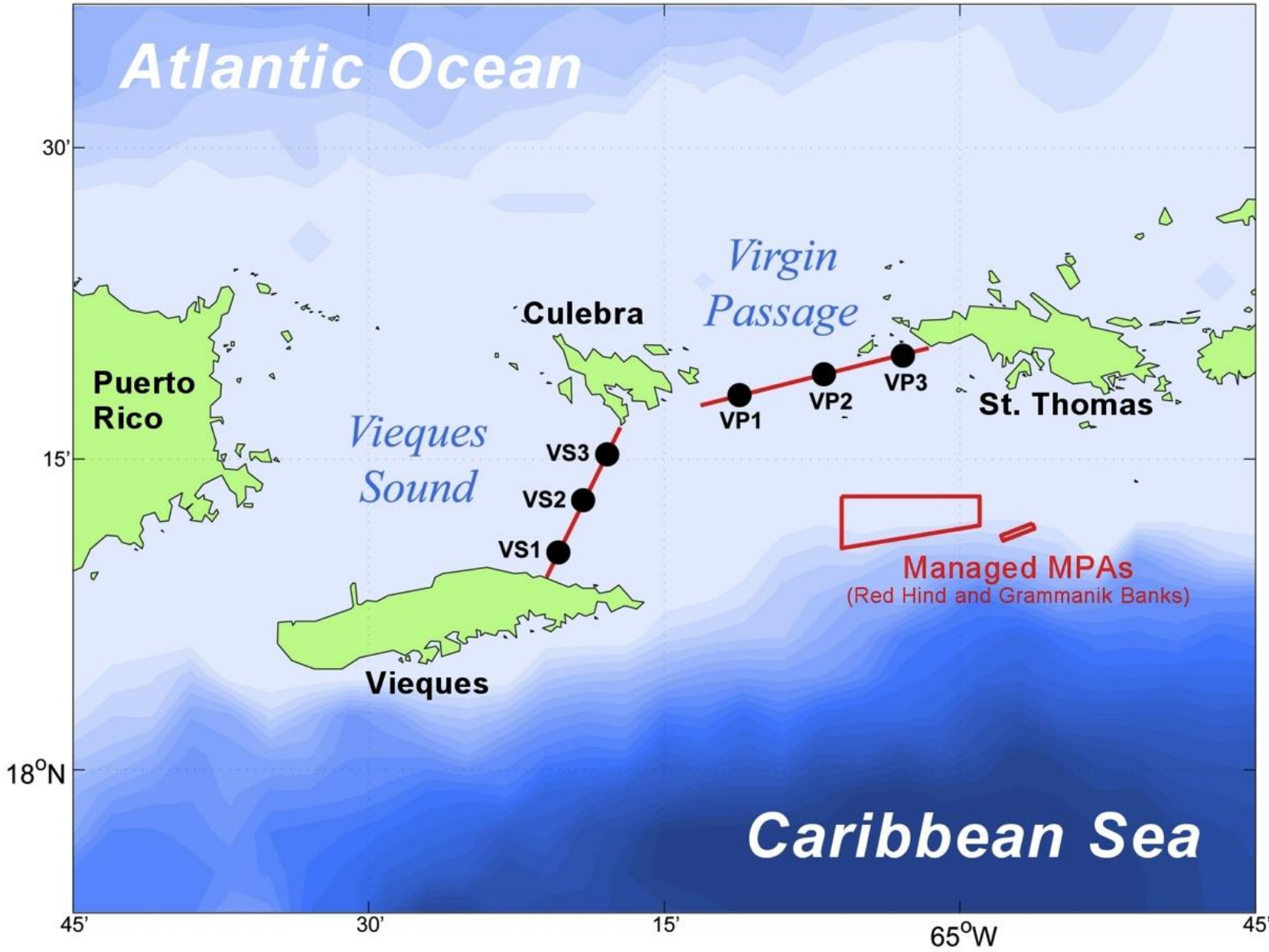
- This study is designed to characterize and quantify the poorly understood flow dynamics and ichthyoplankton flux across the USVI and PR coastal shelf.
- This study will provide scientists and managers with an understanding of the biological and physical connectivity between regional MPAs and adjacent non-managed areas.
- This study supports the development and implementation of a ground-truthed 3D hydrodynamic model (ROMS: North Eastern Caribbean Model) with a resolution (up to330 meters) sufficient to characterize flow across USVI and PR banks and through narrow island passages.

# Coral Reef Ecosystem Research

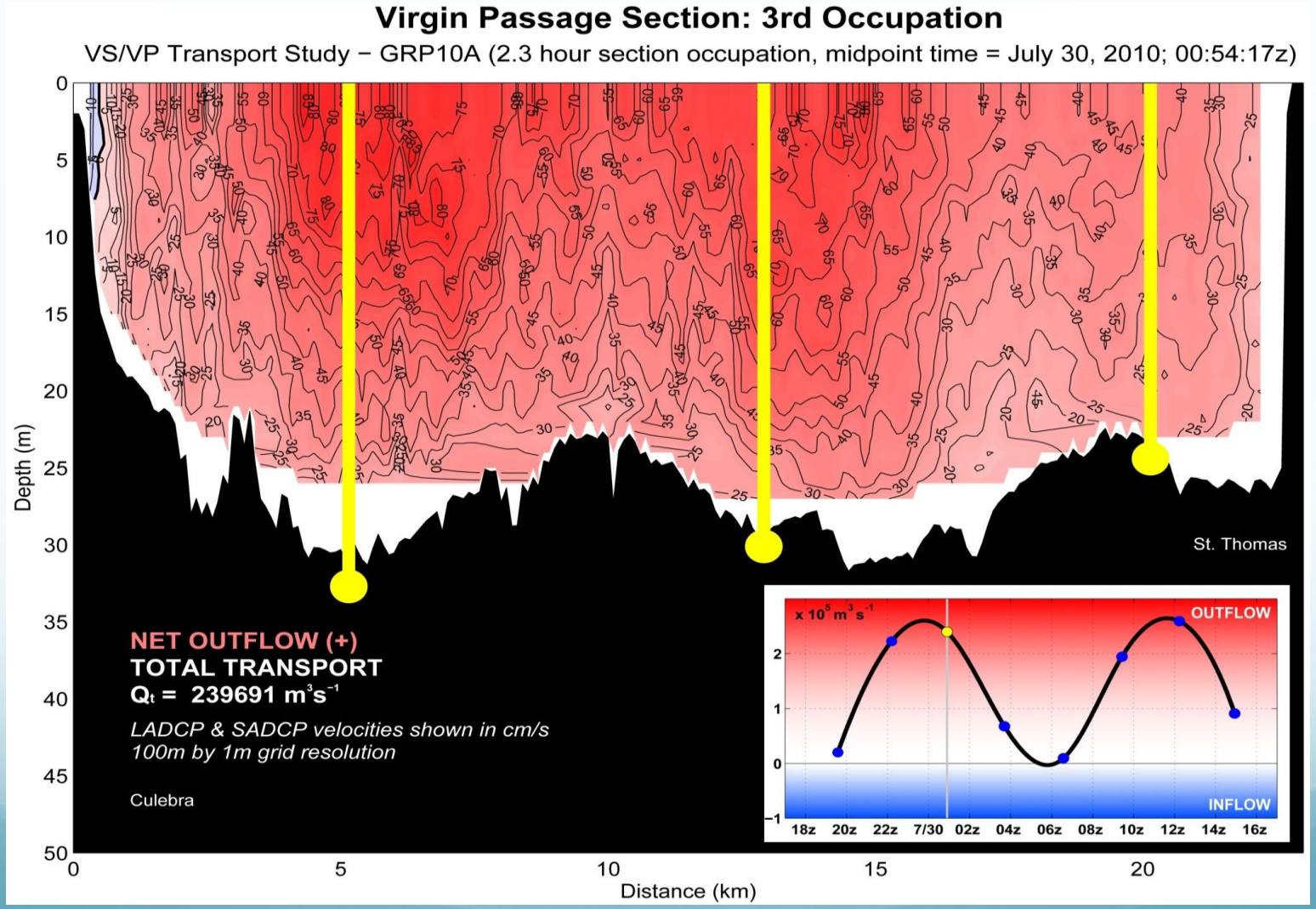
## *USVI Larval Reef Fish Distribution and Supply Study 2007 – 2011* (AOML and SEFSC)



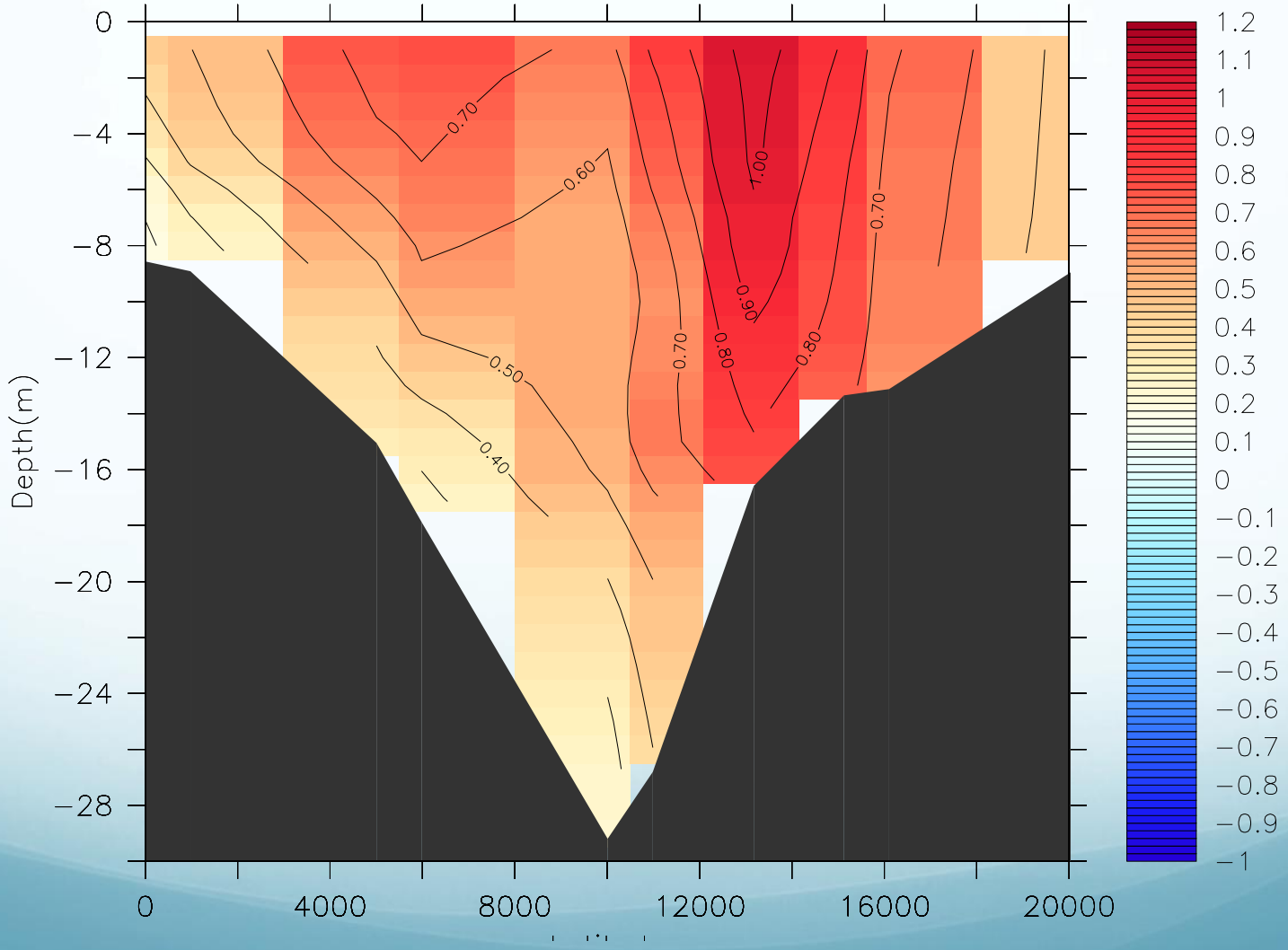
# Vieques Sound and Virgin Passage Transport Study



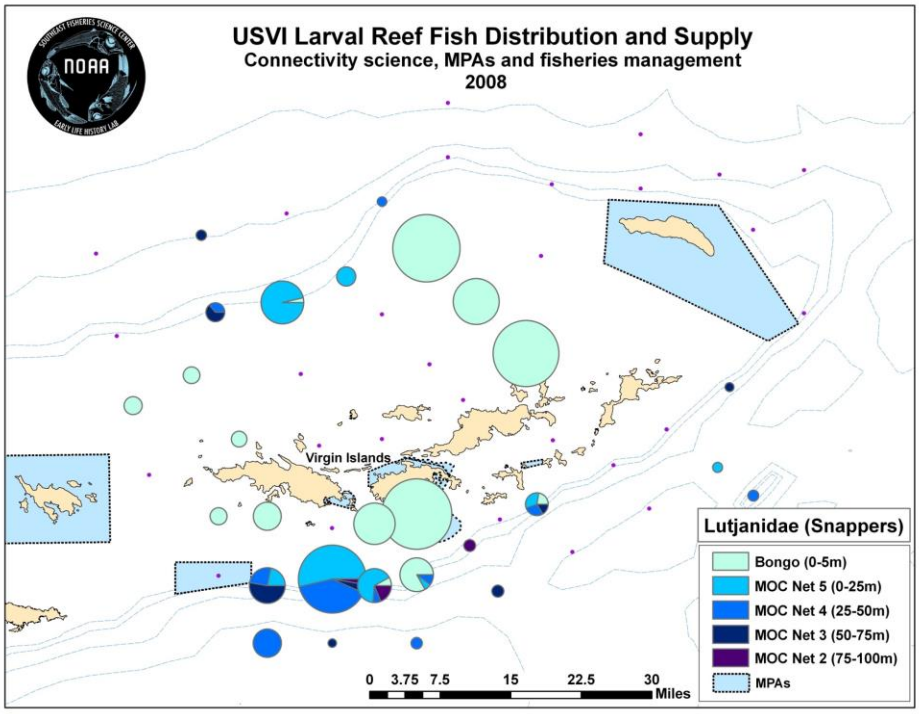
# Virgin Passage Transport



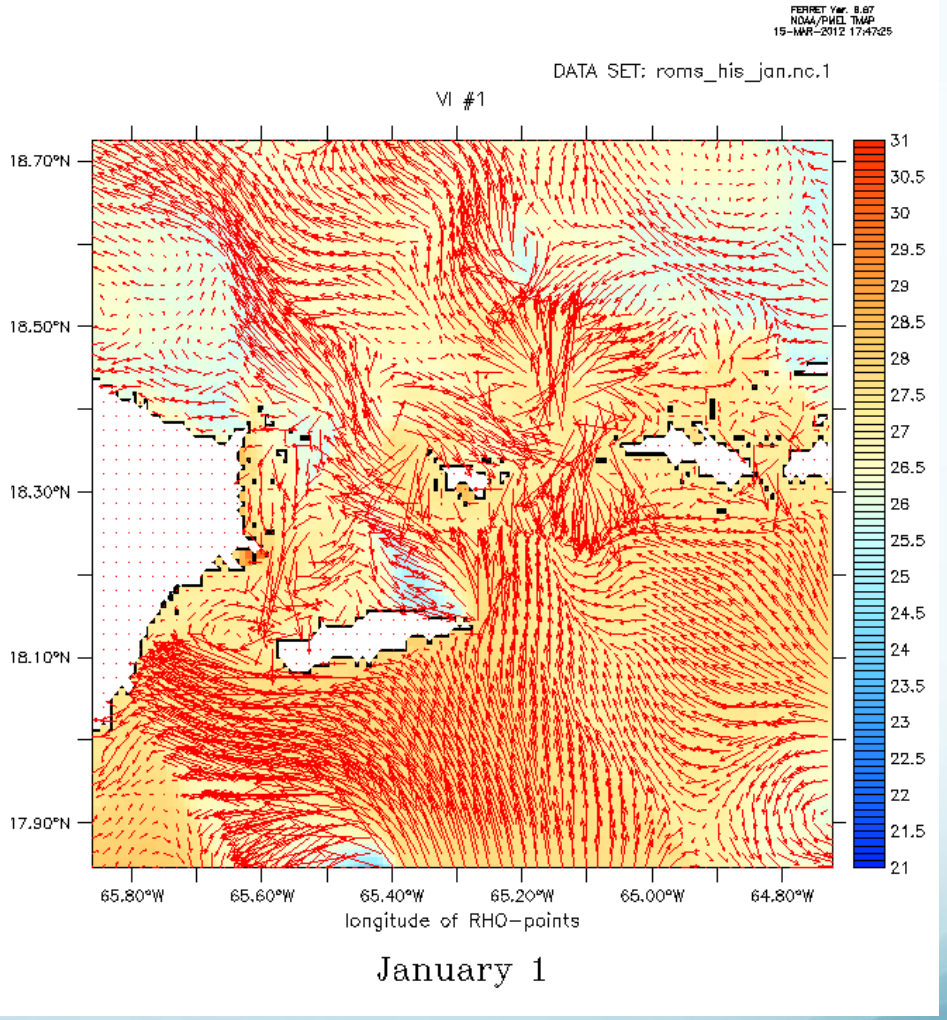
# Virgin Passage Transport



*What linkages exists between spawning aggregation sites south of St. Thomas and banks to the north and west, via Vieques Sound and Virgin Passage?*

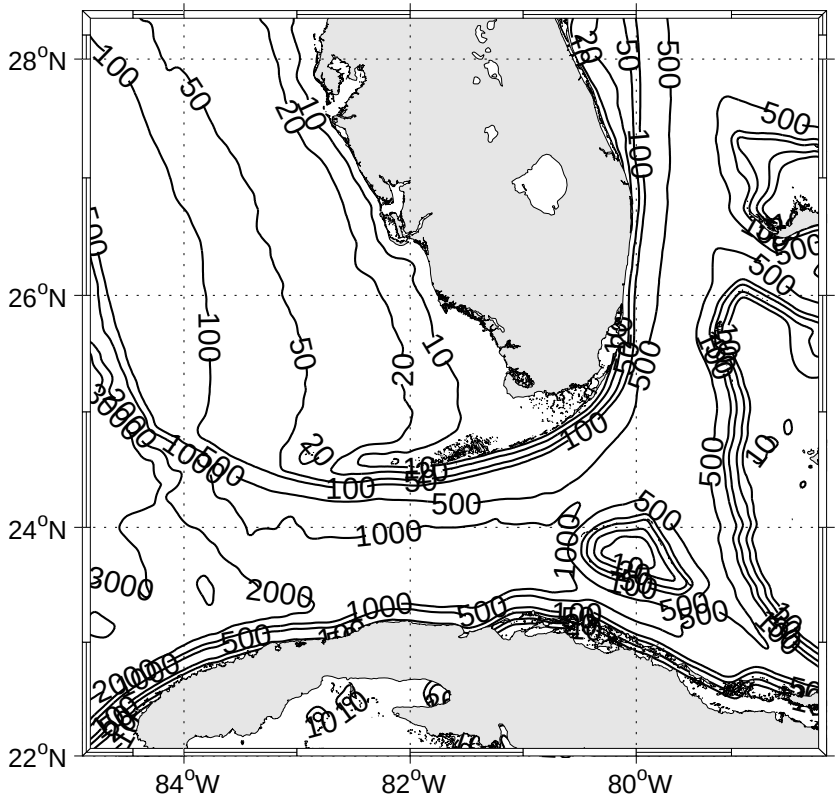


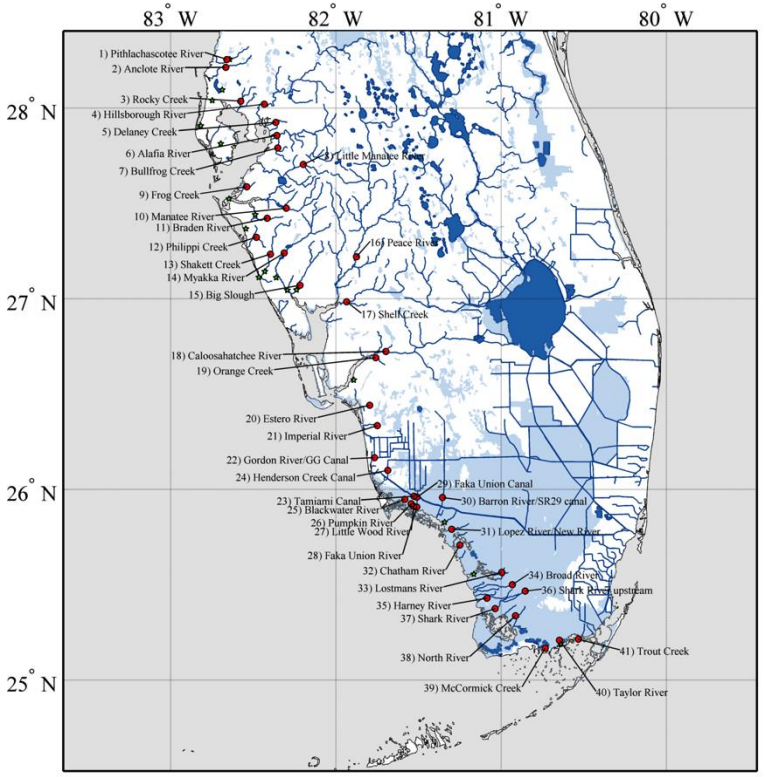

J. Lamkin
Relative Haul, Lutjanidae (snapper)



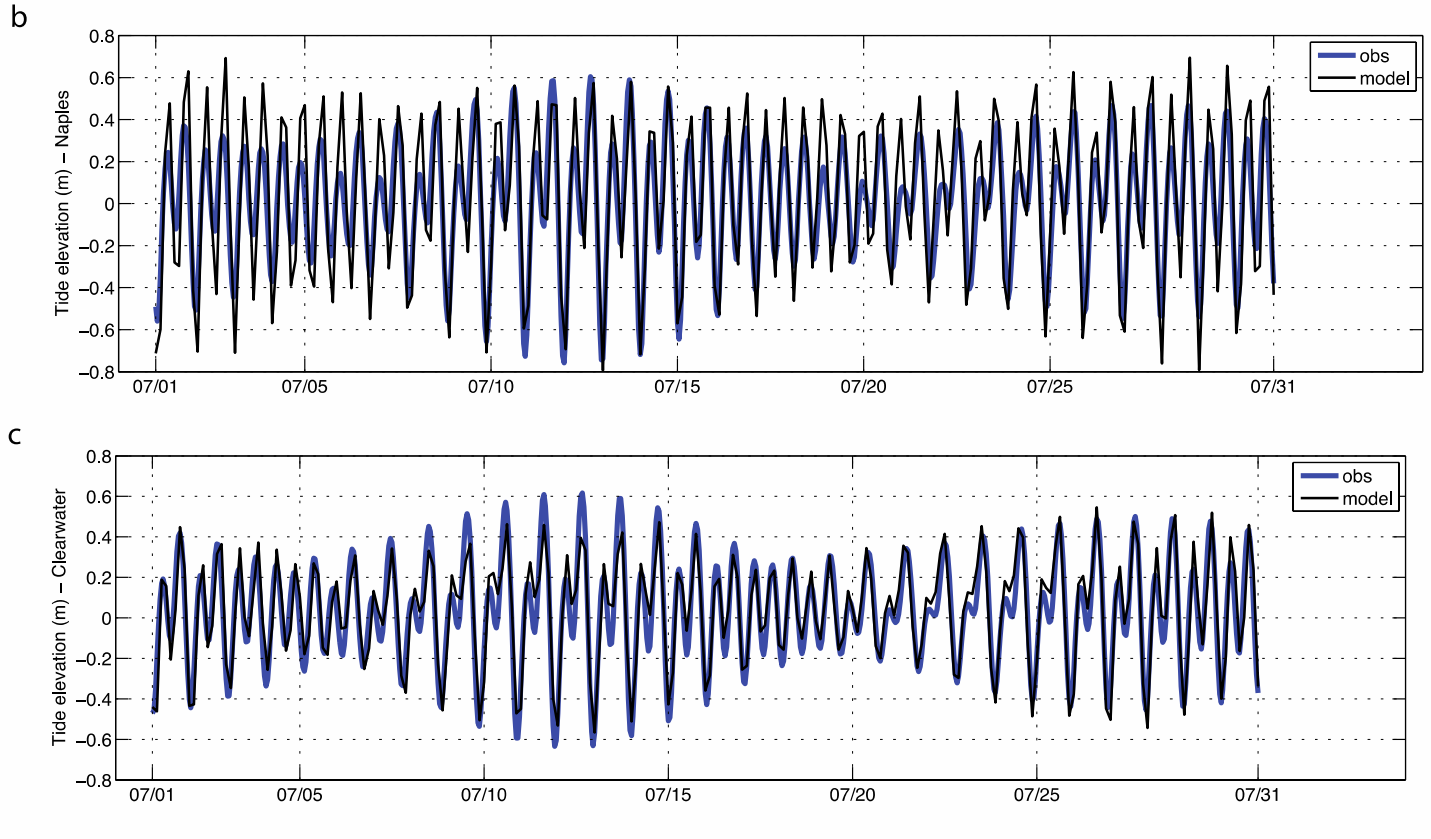

L. Cherubin
ROMS: North Eastern Caribbean Circulation Model
Jan 1, 2007 – Mar 3, 2007

# SWF Shelf Model

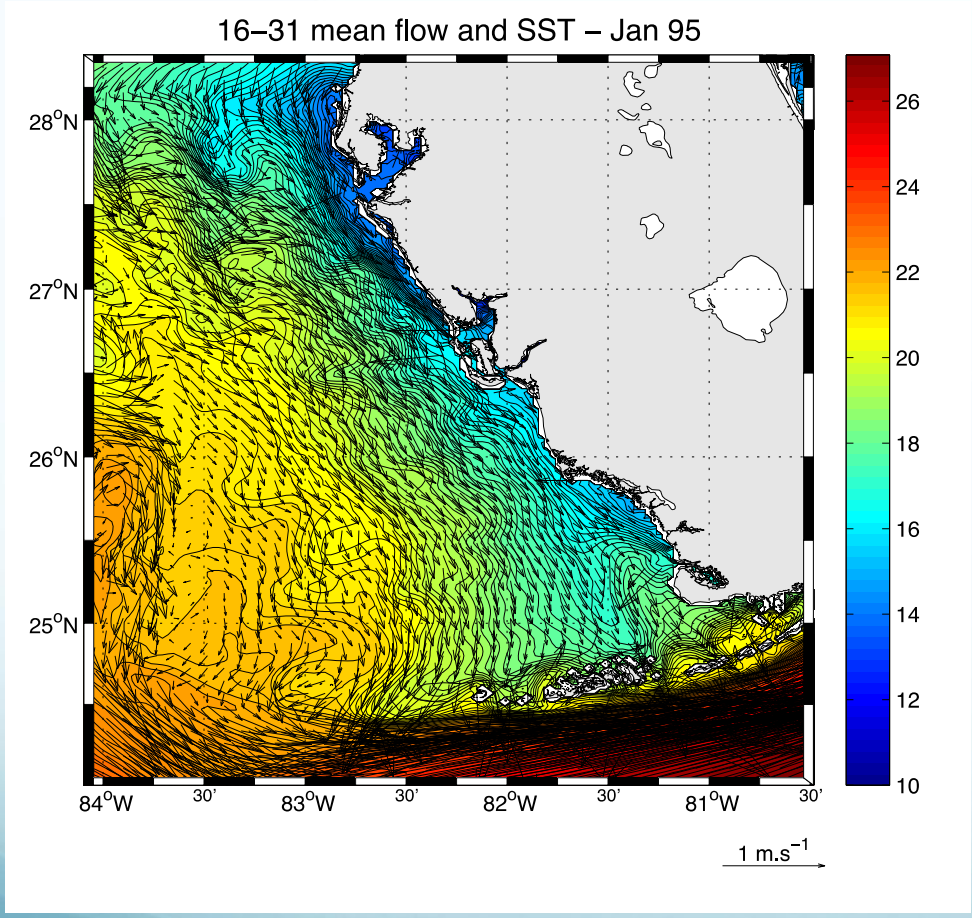


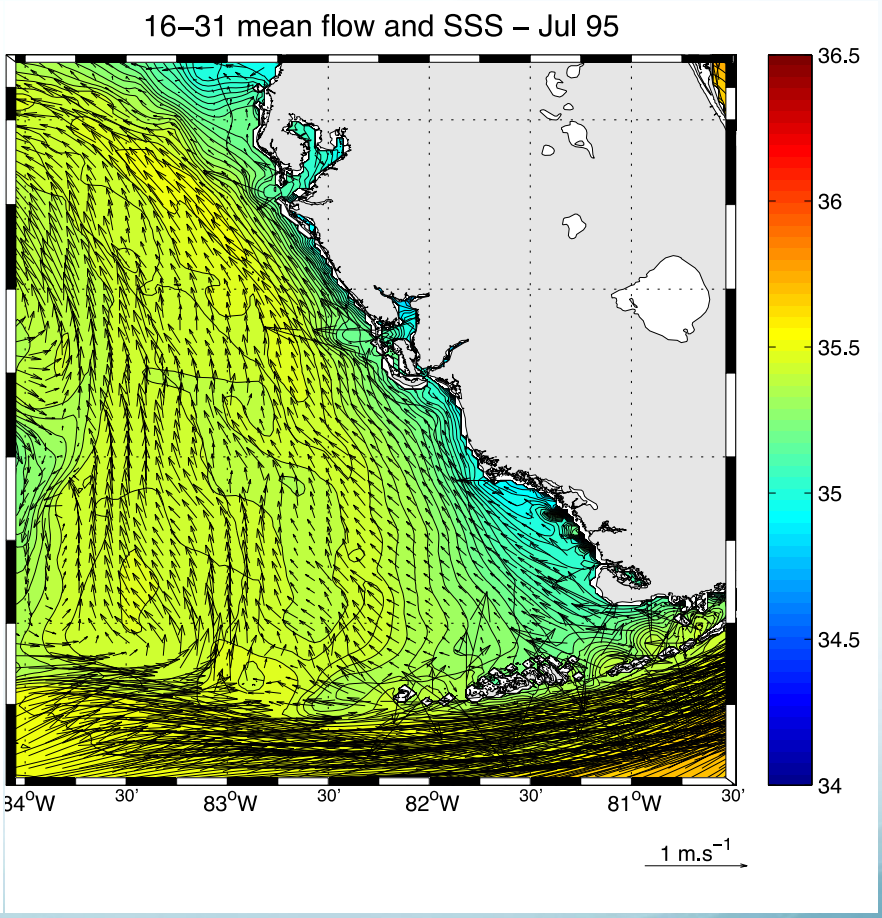



# Model tides


b
Tide elevation (m) – Naples
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
07/01
07/05
07/10
07/15
07/20
07/25
07/31
obs
model
c
Tide elevation (m) – Clearwater
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
07/01
07/05
07/10
07/15
07/20
07/25
07/31
obs
model

# Seasonal cycle

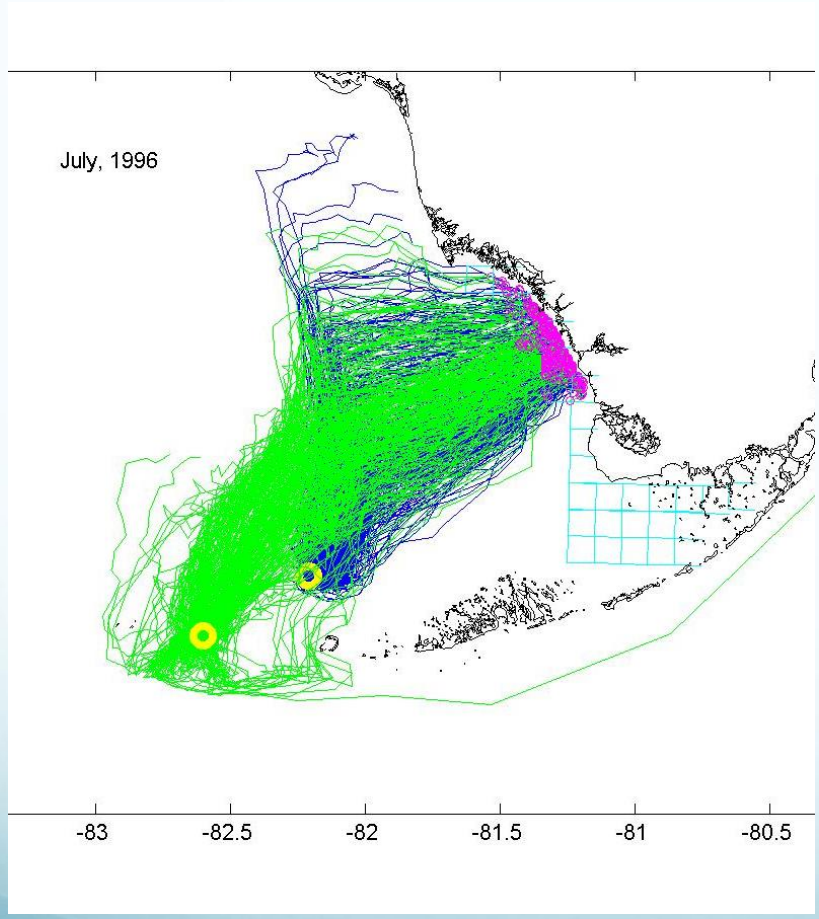


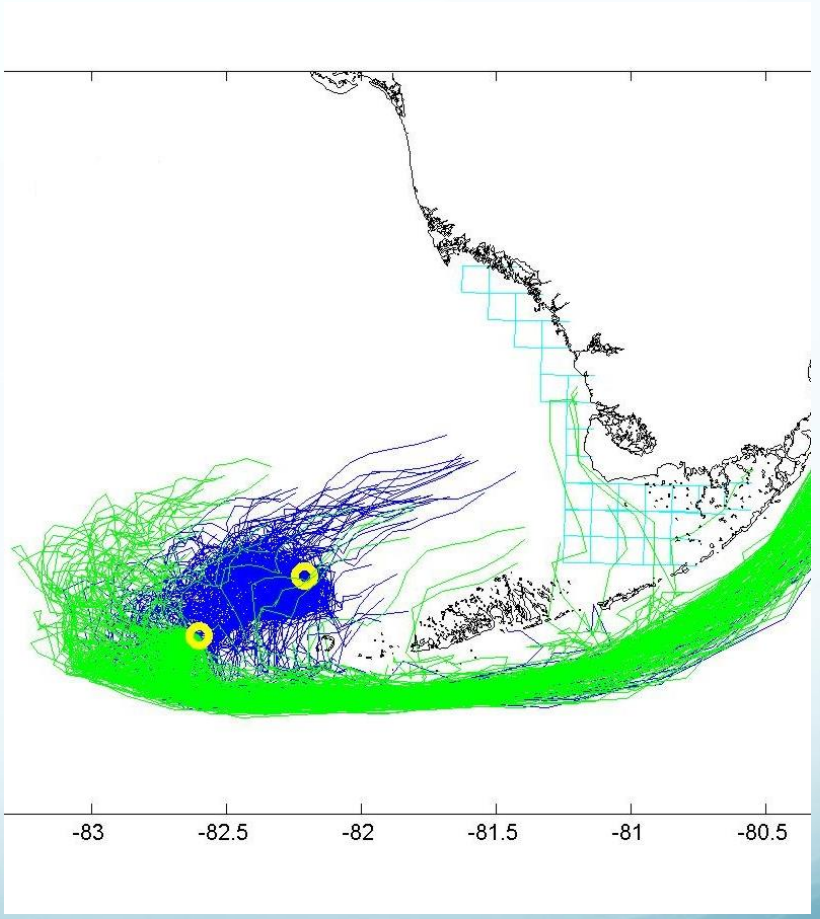
# Larval behavior

- Spawning grounds: Dry Tortugas and Marquesas
- Larval ontogeny
  - First 15 days: DVM
  - Last 15 days: STST (Selective Tidal Stream Transport)

# Cross-shelf transport




July 1996




March 1997

# Conclusions

- Ocean models can be powerful tools:
  - Dynamics of coastal regions
  - Fill in the gaps left by discrete in-situ sampling
  - Identify key mechanisms in marine organisms life history

# Partners

- Ryan Smith
- John Lamkin
- Nasseer Idrisi
- Joan Browder
- Maria Criales
- Claire Paris





- Support from NOAA's:
  - Coral Reef Conservation Program (CRCP)
  - Fisheries And The Environment (FATE)